REMARKS

Allowable Subject Matter

The indication, by the Examiner, that claims 3, 4, 7, 9, 12, and 14 set forth allowable subject matter is noted with appreciation.

Foreign Priority

The acknowledgement, in the Office Action, of a claim for foreign priority under 35 U.S.C. § 119(a)-(d), and that the certified copy of the priority document has been received, is noted with appreciation.

Status Of Application

Claims 1-17 were pending in the application; the status of the claims is as follows:

Claim 15 is objected to because of an informality in line 3, wherein it is believed that applicants intended to recite "has" rather than "gas".

Claims 1-5 are rejected under the second paragraph of 35 U.S.C. § 112 as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicants regard as the invention.

Claims 1, 2, 5, 10, 11, 13, and 16 are rejected under 35 U.S.C. § 102(b) as being anticipated by Japanese Publication 62-58883 to Okada et al (hereinafter "the Okada publication").

Claims 6, 8, 13, and 15-17 are rejected under 35 U.S.C. § 102(b) as being anticipated by Japanese Publication 53-82286 to Takekida (hereinafter "the Takekida publication").

Claims 6, 8, 15, and 17 are rejected under 35 U.S.C. § 103(a) as being unpatentable over the Okada publication in view of the Takekida publication.

Claims 3, 4, 7, 9, 12, and 14 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims and, in the case of claims 3 and 4, also rewritten to overcome the § 112 rejection thereof.

compound member to an object to be driven", and a driver "for resonantly driving the displacing devices so as to move the compound member along an elliptic or a circular trail."

The Okada publication, an English translation of which is provided herewith for the Examiner's convenience, is directed towards a driving apparatus. As shown in Fig. 1 of the Okada publication, the driving apparatus includes a pair of piezoelectric elements 1 and 2, each fixed at one end to a base 10, and each fixed at another end to a respective one of two flexible structures 7. Each flexible structure 7 is, in turn, connected to a single driving end portion 8.

An operation of the Okada driving apparatus is explained in the English translation of the Okada publication beginning at page 6, line 15. As described therein, in order to move the object to be driven 9 in a first direction, an AC voltage is applied to the piezoelectric element 1 so that the piezoelectric element 1 vibrates in the directions shown by arrow 5 in Fig. 1, and the vibrations are transferred to the driving end portion 8 to displace it in the directions shown by arrow 5. Then, in order to move the object to be driven 9 in the opposite direction, an AC voltage is applied to the piezoelectric element 2 so that the piezoelectric element 2 vibrates in the directions shown by arrow 6 in Fig. 1, and the vibrations are transferred to the driving end portion 8 to displace it in the directions shown by arrow 6. Therefore, the driving end portion 8 only moves in the directions shown by arrows 5 or in the directions shown by arrows 6. Thus, the Okada publication fails to disclose driving the driving end portion 8 along an elliptic or a circular trail.

Further, the Okada publication discloses, in the embodiment shown in Fig. 4, the addition of elastic members 3 and 4 inside the piezoelectric elements 1 and 2, respectively. As explained from page 9, line 20 to page 10, line 5 of the enclosed English translation of the Okada publication, the elastic members 3 and 4 are for compressing the piezoelectric elements 1 and 2, respectively, rather than for pressing the driving end portion 8 towards

the object to be driven 9. Thus, the Okada publication fails to disclose a pressing member for pressing the compound member to an object to be driven.

Since the Okada publication fails to disclose all of the limitations of claim 1, the Okada publication cannot anticipate claim 1. Also, since claims 2 and 5 depend from claim 1, the Okada publication cannot anticipate claim 2 and 5 for at least the reasons stated above.

Claims 10 and 11

By this Amendment, claim 10 has been cancelled, thereby rendering moot the § 102 rejection thereof.

Claim 11 has been rewritten to depend from allowable claim 12, and is considered to be in condition for allowance for at least the reason of depending from an allowable claim.

Claim 13

Claim 13 is directed towards a method for driving an actuator, and, as amended, recites *inter alia*:

> driving each of the first displacing device and the second displacing device in a manner so as to move the compound member along an elliptic or a circular trail by using a first displacing device driving signal and a second displacing device driving signal, respectively, each of the driving signals having a frequency that is between a first frequency and a second frequency,
>
> wherein the first frequency is a higher one of a resonant frequency of the first displacing device and a resonant frequency of the second displacing device, and
>
> wherein the second frequency is a lower one of an antiresonant frequency of the first displacing device and an antiresonant frequency of the second displacing device.

Thus, according to the method of claim 13, each of a first and a second displacing device is driven in a manner so as to move the compound member along an elliptic or a circular trail using a driving signal having a certain frequency. That certain frequency is in a region that is between the larger of the respective resonant frequencies of the two displacing devices and the smaller of the respective antiresonant frequencies of the two displacing devices.

The Okada publication is directed towards a driving apparatus that includes a pair of piezoelectric elements 1 and 2, each connected to a driving end portion 8 and a base 10. In the English translation of the Okada publication, it states that each of the piezoelectric elements 1 and 2 are resonantly driven, i.e. using a driving signal having a frequency corresponding to the respective element's resonant frequency. However, the Okada patent fails to disclose any other frequencies as being suitable for a driving signal. In particular, the Okada patent fails to disclose driving the piezoelectric elements using any of the frequencies between the larger of the respective resonant frequencies of the two displacing devices and the smaller of the respective antiresonant frequencies of the two displacing devices. In addition, as pointed out above, the Okada publication fails to disclose driving the driving end portion 8 along an elliptic or a circular trail. Therefore, since the Okada publication fails to disclose all of the limitations of claim 13, the Okada publication cannot anticipate claim 13.

<u>Claim 16</u>

Claim 16 is directed towards a method for driving an actuator, and, as amended, recites *inter alia*:

> sensing a current flowing through the first displacing device and a current flowing through the second displacing device.

Thus, claim 16 includes a step of sensing the current flowing through the first and second displacing devices. The Okada publication is silent with regard to sensing the current flowing through the piezoelectric elements 1 and 2. Therefore, since the Okada

publication fails to disclose all of the limitations of claim 16, the Okada publication cannot anticipate claim 16.

Accordingly, it is respectfully requested that the rejection of claims 1, 2, 5, 11, 13, and 16 under 35 U.S.C. § 102(b) as being anticipated by the Okada publication, be reconsidered and withdrawn.

35 U.S.C. § 102(b) Rejections - The Takekida Publication

The rejection of claims 6, 8, 13, and 15-17 under 35 U.S.C. § 102(b) as being anticipated by the Takekida publication, is respectfully traversed based on the following.

Claims 6 and 8

Claim 6 is directed towards an actuator, and, as amended, recites *inter alia*:

> a driver for resonantly driving the displacing devices so as to move the compound member along an elliptic or a circular trail,
>
> wherein the driver drives the first displacing device and the second displacing device by driving signals respectively having a frequency that is between a first frequency and a second frequency,
>
> wherein the first frequency is a higher one of a resonant frequency of the first displacing device and a resonant frequency of the second displacing device, and
>
> wherein the second frequency is a lower one of an antiresonant frequency of the first displacing device and an antiresonant frequency of the second displacing device.

Thus, according to claim 6, each of a first and a second displacing device is driven using a respective driving signal having a certain frequency. That certain frequency is in a region that is between the larger of the respective resonant frequencies of the two displacing devices and the smaller of the respective antiresonant frequencies of the two displacing devices.

The Takekida publication is directed towards a motor, which includes piezoelectric elements, a rotor, and a hook mechanism, in which the piezoelectric elements are used as a

Therefore, since the Takekida publication fails to disclose all of the limitations of claim 16, the Takekida publication cannot anticipate claim 16.

Since claim 17 depends from claim 16, the Takekida publication cannot anticipate claim 17 for at least the same reasons discussed above regarding claim 16.

Accordingly, it is respectfully requested that the rejection of claims 6, 8, 13, and 15-17 under 35 U.S.C. § 102(b) as being anticipated by the Takekida publication, be reconsidered and withdrawn.

35 U.S.C. § 103(a) Rejections

The rejection of claims 6, 8, 15, and 17 under 35 U.S.C. § 103(a), as being unpatentable over the Okada publication in view of the Takekida publication, is respectfully traversed based on the following.

Claims 6 and 8

As discussed above, according to claim 6, each of a first and a second displacing device is driven using a respective driving signal having a certain frequency. That certain frequency is in a region that is between the larger of the respective resonant frequencies of the two displacing devices and the smaller of the respective antiresonant frequencies of the two displacing devices.

As pointed out above, the Okada publication is silent with regard to using any driving frequency other than resonant frequency, and the Takekida publication is silent with regard to a frequency for the drive voltages. Therefore, if one skilled in the art were to combine the teachings of the Okada publication and the Takekida publication, the resulting combination would only disclose or suggest using resonant frequency. In other words, the combination of the Okada publication and the Takekida publication would fail to disclose or suggest using a drive frequency that is in a region between a larger of the respective resonant frequencies of two displacing devices and a smaller of the respective

antiresonant frequencies of the two displacing devices. Therefore, since the combination of the Okada publication and the Takekida publication fails to disclose or suggest all of the limitations of claim 6, the combination cannot render obvious claim 6.

Since claim 8 depends from claim 6, the combination of the Okada publication and the Takekida publication cannot render obvious claim 8 for at least the same reasons discussed above regarding claim 6.

<u>Claim 15</u>

Claim 15 depends from claim 13. As discussed above, according to the method of claim 13, each of a first and a second displacing device is driven using a respective driving signal having a certain frequency. That certain frequency is in a region that is between the larger of the respective resonant frequencies of the two displacing devices and the smaller of the respective antiresonant frequencies of the two displacing devices.

As pointed out above, the combination of the Okada publication and the Takekida publication fails to disclose or suggest using a drive frequency that is in a region between a larger of the respective resonant frequencies of two displacing devices and a smaller of the respective antiresonant frequencies of the two displacing devices. Since the combination of the Okada publication and the Takekida publication fails to disclose or suggest all of the limitations of claim 13, the combination cannot render obvious claim 13, and therefore cannot render obvious claim 15 which depends from claim 13.

<u>Claim 17</u>

Claim 17 depends from claim 16. As discussed above, claim 16 includes a step of sensing the current flowing through the first and second displacing devices. However, as pointed out above, the Takekida publication and the Okada publication are both silent with regard to sensing the current flowing through the piezoelectric elements. Thus, if one skilled in the art were to combine the teachings of the Takekida publication and the Okada publication, the resulting combination would still be silent with regard to sensing the

current flowing through the piezoelectric elements. Since the combination of the Okada publication and the Takekida publication fails to disclose or suggest all of the limitations of claim 16, the combination cannot render obvious claim 16 and, therefore, cannot render obvious claim 17 which depends from claim 16.

Accordingly, it is respectfully requested that the rejection of claims 6, 8, 15, and 17 under 35 U.S.C. § 103(a), as being unpatentable over the Okada publication in view of the Takekida publication, be reconsidered and withdrawn.

CONCLUSION

Wherefore, in view of the foregoing amendments and remarks, this application is considered to be in condition for allowance, and an early reconsideration and a Notice of Allowance are earnestly solicited.

This Amendment increases the number of independent claims by three to eight from five independent claims, but does not increase the total number of claims, and does not present any multiple dependency claims. Accordingly, a Response Transmittal and Fee Authorization form authorizing the amount of $252.00 to be charged to Sidley Austin Brown & Wood's Deposit Account No. 18-1260 is enclosed herewith in duplicate. However, if the Response Transmittal and Fee Authorization form is missing, insufficient, or otherwise inadequate, or if a fee, other than the issue fee, is required during the pendency of this application, please charge such fee to Sidley Austin Brown & Wood's Deposit Account No. 18-1260. Please credit any overpayment to Sidley Austin Brown & Wood's Deposit Account No. 18-1260.

If an extension of time is required to enable this document to be timely filed and there is no separate Petition for Extension of Time filed herewith, this document is to be construed as also constituting a Petition for Extension of Time Under 37 C.F.R. § 1.136(a) for a period of time sufficient to enable this document to be timely filed.

Any other fee required for such Petition for Extension of Time and any other fee required by this document pursuant to 37 C.F.R. §§ 1.16 and 1.17, other than the issue fee, and not submitted herewith should be charged to Sidley Austin Brown & Wood's Deposit Account No. 18-1260. Any refund should be credited to the same account.

Respectfully submitted,

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APPENDIX

VERSION WITH MARKINGS TO SHOW CHANGES MADE

The following is a marked-up version of the changes to the claims which are being made in the attached response to the Office Action dated May 16, 2001.

IN THE CLAIMS:

1. (Once Amended) An actuator comprising:

a plurality of displacing devices for generating displacements;

a compound [member] member, connected to the displacing [devices and] devices, for compounding displacements of the displacing devices;

a base member for [folding] holding base ends of the displacing devices to [at] which the compound member is not connected;

a pressing member for pressing the compound member to an object to be driven; and

a driver for resonantly driving the displacing devices so as to move the compound member along an elliptic or a circular trail.

2. (Once Amended) [The] An actuator in accordance with claim 1, wherein a natural frequency of the displacing devices in a first natural vibration [mode] mode, in which the displacing devices are resonantly vibrated in the same [phase] phase, substantially coincides with a natural frequency of the displacing devices in a second natural vibration [mode] mode, in which the displacing devices are resonantly vibrated in the opposite phase.

3. (Once Amended) [The] An actuator in accordance with claim 2, wherein a mass of the compound member is designated by a symbol "M", a length of [the] each displacing device is designated by a symbol "L", a height of [the] each displacing device is designated by a symbol "H", and a mass of [the] each displacing device is designated by a symbol "m", and the equation

$M=(L^2/H^2-0.88)m/2.63$

is [composed.] satisfied.

4. (Once Amended) [The] An actuator in accordance with claim 2,

wherein a mass of the compound member is designated by a symbol "M_c", a mass of each displacing device is designated by a symbol "m", a spring constant of [the] each displacing device in the expansive deformation is designated by a symbol "k_1", a spring constant of [the] each displacing device in the bending deformation is designated by a symbol "k_3", a moment of inertia of the base member is designated by a symbol "I_z", a rotation radius of the base member is designated by a symbol "R", and an equivalent mass of the base member converted to a cantilever is designated by a symbol "M_b'", and the equations

$(k_1/(1-p))/(M_c+(1-p)m/3)=(k_1/(1-q)+k_3)/(M_c+(1-q)m/3+m/2)$

$p=(M_c+m/3)/(M_c+I_z/R^2+2m/3)$

$q=(M_c+5m/6)/(M_c+M_b'+7m/6)$

are [composed.] satisfied.

5. (Once Amended) [The] An actuator in accordance with claim 1, wherein at least one of the plurality of displacing [device] devices includes an elastic member as a part thereof.

6. (Once Amended) An actuator comprising:

a first displacing device;

a second displacing device;

a compound member connected to top ends of the first displacing device and the second displacing device and for compounding displacements of the first displacing device and the second displacing device; and

a driver for resonantly driving the displacing devices so as to move the compound member along an elliptic or a circular [trail; and] trail,

wherein the driver drives the first displacing device and the second displacing device by driving signals respectively having a frequency that is between a first frequency

and a second frequency, [included in an overlapped region of a first frequency band and a second frequency band;]

wherein the first frequency is a higher one of a resonant frequency of the first displacing device and a resonant frequency of the second displacing device, and

wherein the second frequency is a lower one of an antiresonant frequency of the first displacing device and an antiresonant frequency of the second displacing device.

[the first frequency band is defined as a region between the resonance frequency and the antiresonance frequency of the first displacing device in which a phase difference between a phase of a voltage of the driving signal and a phase of a current flowing in the first displacing device is substantially constant; and the second frequency band is defined as a region between the resonance frequency and the antiresonance frequency of the second displacing device in which a phase difference between a phase of a voltage of the driving signal and a phase of a current flowing in the second displacing device is substantially constant.]

7. (Twice Amended) [The] An actuator comprising: [in accordance with claim 6,]

a first displacing device;

a second displacing device;

a compound member connected to top ends of the first displacing device and the second displacing device and for compounding displacements of the first displacing device and the second displacing device; and

a driver for resonantly driving the displacing devices so as to move the compound member along an elliptic or a circular trail,

wherein the driver drives the first displacing device and the second displacing device by using a first displacing device driving signal and a second displacing device driving signal, respectively, each of the driving signals having a frequency included in an overlapped region of a first frequency band and a second frequency band,

wherein the first frequency band is defined as a region between a resonance frequency of the first displacing device and an antiresonance frequency of the first displacing device in which a phase difference between a phase of a voltage of the first

displacing device driving signal and a phase of a current flowing in the first displacing device is substantially constant,

wherein the second frequency band is defined as a region between a resonance frequency of the second displacing device and an antiresonance frequency of the second displacing device in which a phase difference between a phase of a voltage of the second displacing device driving signal and a phase of a current flowing in the second displacing device is substantially constant,

wherein the frequency of the driving signals is a value at the center between a first frequency and a second [frequency;] frequency,

wherein the first frequency is [the] a smaller one of the resonance frequencies of the first displacing device and the second displacing [device;] device, and

wherein the second frequency is [the] a smaller one of the antiresonance frequencies of the first displacing device and the second displacing device.

8. (Twice Amended) [The] An actuator in accordance with claim 6, wherein the phase of the driving signal for driving the first displacing device has a phase difference with respect to the driving signal for driving the second displacing device.

9. (Once Amended) [The] An actuator comprising: [in accordance with claim 6,]

a first displacing device;

a second displacing device;

a compound member connected to top ends of the first displacing device and the second displacing device and for compounding displacements of the first displacing device and the second displacing device;

a driver for resonantly driving the displacing devices so as to move the compound member along an elliptic or a circular trail, and

[further comprising] current sensors respectively for sensing currents flowing in the first displacing device and the second displacing [device.] device,

wherein the driver drives the first displacing device and the second displacing device by using a first displacing device driving signal and a second displacing device

driving signal, respectively, each of the driving signals having a frequency included in an overlapped region of a first frequency band and a second frequency band,

wherein the first frequency band is defined as a region between a resonance frequency of the first displacing device and an antiresonance frequency of the first displacing device in which a phase difference between a phase of a voltage of the first displacing device driving signal and a phase of a current flowing in the first displacing device is substantially constant, and

wherein the second frequency band is defined as a region between a resonance frequency of the second displacing device and an antiresonance frequency of the second displacing device in which a phase difference between a phase of a voltage of the second displacing device driving signal and a phase of a current flowing in the second displacing device is substantially constant.

10. (Cancelled)

11. (Once Amended) [The] An actuator in accordance with claim [10,] 12, wherein a phase difference is provided between the driving signals in a manner so that a current flowing in the first displacing device has a predetermined phase difference with respect to a current flowing in the second displacing device.

12. (Once Amended) [The] An actuator [in accordance with claim 10, further comprising] comprising:

a first displacing device;

a second displacing device;

a compound member connected to top ends of the first displacing device and the second displacing device and for compounding displacements of the first displacing device and the second displacing device;

a driver for resonantly driving the displacing devices so as to move the compound member along an elliptic or a circular trail; and

current sensors respectively for sensing currents flowing in the first displacing device and the second displacing [device.] device,

wherein the driver drives the first displacing device and the second displacing device by driving signals respectively having a frequency included in a frequency band in the vicinity of resonance frequencies of the first displacing device and the second displacing device at which a displacement of the first displacing device is substantially the same as that of the second displacing device.

13. (Once Amended) A method for driving an actuator [comprising:] which comprises a first displacing [device;] device, a second displacing [device;] device, and a compound member connected to top ends of the first displacing device and the second displacing device [and] for compounding displacements of the first displacing device and the second displacing [device; wherein] device, said method comprising the step of:

driving each of the first displacing device and the second displacing device [are driven] in a manner so as to move the compound member along an elliptic or a circular trail by using a first displacing device driving signal and a second displacing device driving signal, respectively, each of the driving signals [respectively] having a frequency that is between a first frequency and a second frequency,

wherein the first frequency is a higher one of a resonant frequency of the first displacing device and a resonant frequency of the second displacing device, and

wherein the second frequency is a lower one of an antiresonant frequency of the first displacing device and an antiresonant frequency of the second displacing device. [included in an overlapped region of a first frequency band and a second frequency band;

the first frequency band is defined as a region between the resonance frequency and the antiresonance frequency of the first displacing device in which a phase difference between a phase of a voltage of the driving signal and a phase of a current flowing in the first displacing device is substantially constant; and

the second frequency band is defined as a region between the resonance frequency and the antiresonance frequency of the second displacing device in which a phase difference between a phase of a voltage of the driving signal and a phase of a current flowing in the second displacing device is substantially constant.]

14. (Twice Amended) [The] A method for driving [the] an actuator [in accordance with claim 13,] which comprises a first displacing device, a second displacing device, and a compound member connected to top ends of the first displacing device and the second displacing device for compounding displacements of the first displacing device and the second displacing device, said method comprising the step of:

driving each of the first displacing device and the second displacing device in a manner so as to move the compound member along an elliptic or a circular trail by using a first displacing device driving signal and a second displacing device driving signal, respectively, each of the driving signals having a frequency included in an overlapped region of a first frequency band and a second frequency band,

wherein the first frequency band is defined as a region between a resonance frequency of the first displacing device and an antiresonance frequency of the first displacing device in which a phase difference between a phase of a voltage of the first displacing device driving signal and a phase of a current flowing in the first displacing device is substantially constant,

wherein the second frequency band is defined as a region between a resonance frequency of the second displacing device and an antiresonance frequency of the second displacing device in which a phase difference between a phase of a voltage of the second displacing device driving signal and a phase of a current flowing in the second displacing device is substantially constant,

wherein the frequency of the driving signals is a value at [the] a center between a first frequency and a second [frequency;] frequency,

wherein the first frequency is [the] a smaller one of the resonance frequencies of the first displacing device and the second displacing [device;] device, and

wherein the second frequency is [the] a smaller one of the antiresonance frequencies of the first displacing device and the second displacing device.

15. (Once Amended) [The] A method for driving the actuator in accordance with claim 13, wherein the phase of the first displacing device driving signal [for driving the first displacing device gas] has a phase difference with respect to the second displacing device driving [signal for driving the second displacing device.] signal.

16. (Once Amended) A method for driving an actuator [comprising:] which comprises a first displacing [device;] device, a second displacing [device;] device, and a compound member connected to top ends of the first displacing device and the second displacing device [and] for compounding displacements of the first displacing device and the second displacing [device; wherein] device, said method comprising the step of:

driving each of the first displacing device and the second displacing device [are driven] in a manner so as to move the compound member along an elliptic or a circular trail by using a first displacing device driving signal and a second displacing device driving signal, respectively, each of the driving signals [respectively] having a frequency included in a frequency band in the vicinity of resonance frequencies of the first displacing device and the second displacing device at which a displacement of the first displacing device is substantially the same as that of the second displacing [device.] device; and

sensing a current flowing through the first displacing device and a current flowing through the second displacing device.

17. (Once Amended) [The] A method for driving the actuator in accordance with claim [10, wherein] 16, further comprising the step of adjusting a phase difference [is provided] between the first displacing device driving signal and the second displacing device driving signal [driving signals in a manner] so that [a] the current flowing in the first displacing device has a predetermined phase difference with respect to [a] the current flowing in the second displacing device.